

Smart Contracts in Strategic Alliances: Toward a Theory of Algorithmic-Relational Governance

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Abstract:

Strategic alliances have long required their participants to combine the certainty of formal contracts with the adaptive flexibility of relational mechanisms, and the substitutes-complements debate in alliance governance has spent decades trying to clarify how these two qualities can be combined. The recent emergence of blockchain-enabled smart contracts complicates this picture in interesting ways. This article asks how smart contracts interact with the contractual and relational governance mechanisms documented in the strategic alliance literature, what conditions shape this interaction, and what the implications are for alliance theory. Drawing on the alliance governance literature and the blockchain governance literature in roughly equal measure, the paper develops a framework that positions smart contracts as a third governance mechanism alongside contractual and relational forms, producing a hybrid arrangement termed algorithmic-relational governance. Three propositions are derived and illustrated through a case study of Walmart Canada's DL Freight platform, one of the larger production-grade smart contract deployments in a multi-party alliance setting. The findings suggest that smart contracts function primarily as governance complements rather than substitutes, that they alter alliance dynamics in ways transaction cost economics alone cannot predict, and that their effectiveness depends on deliberate architectural design choices that are themselves products of relational negotiation between alliance partners.

Keywords: strategic alliances; smart contracts; blockchain governance; algorithmic-relational governance; interorganisational trust; alliance governance.

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1. Introduction

Strategic alliances have long been treated as one of the harder organisational forms to manage, and the difficulty has shown few signs of abating. Firms entering cooperative arrangements have to coordinate without the authority that hierarchies provide, share resources without the protection that markets offer through arm's-length exchange, and build the kind of working relationships that allow value to be created jointly rather than captured one-sidedly. None of this is straightforward, and the alliance governance literature has spent several decades trying to clarify how it actually works in practice.

In recent years, however, something has changed in the technological landscape that surrounds these arrangements. Blockchain-enabled smart contracts, programs that execute contractual terms automatically once predefined conditions are met, have moved from conceptual discussion into operational use. Walmart Canada has deployed them across its third-party freight network. Major banks have used them to coordinate complex transactions. Construction firms are experimenting with them in public-private partnerships. The pattern is uneven and the technology is still maturing, but the trend is unmistakable. Smart contracts are being inserted into the kinds of interfirm relationships that alliance scholars have spent decades studying.

What is much less clear is how this technology interacts with the governance mechanisms that those scholars have already documented.

Two streams of literature have developed in parallel, and the conversation between them has been limited. On one side, the alliance governance literature has built up a sophisticated understanding of how contractual and relational mechanisms interact, co-evolve and jointly shape alliance performance (Dyer & Singh, 1998; Poppo & Zenger, 2002; Faems et al., 2008; Krishnan et al., 2016). On the other, a smaller but rapidly growing body of work on blockchain governance has shown how algorithmic mechanisms can automate enforcement, reduce transaction costs and reshape trust dynamics in interorganisational settings (Lumineau et al., 2021; Murray et al., 2021; Chen et al., 2023; Xiong et al., 2025). What is largely missing is a theoretical framework explaining how the new mechanism enters into, reconfigures or potentially disrupts the governance system that strategic alliances have always relied upon.

This article sets out to address that gap. It asks how blockchain-enabled smart contracts interact with the contractual and relational governance mechanisms that scholars have studied for years, what conditions shape this interaction, and what the implications are for the way we theorise alliance governance. The approach is conceptual and integrative, supplemented by an illustrative case. I draw on the alliance governance literature and the blockchain governance literature in roughly equal measure and propose a hybrid form of governance that I term algorithmic-relational governance. In this hybrid form, the codifiable and verifiable dimensions of alliance exchange are governed algorithmically, while the tacit, emergent and ambiguous

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dimensions remain governed relationally. The argument is then grounded in the case of Walmart Canada's DL Freight platform, one of the larger and better documented production-grade smart contract deployments in a multi-party alliance setting.

The contribution of the article is threefold. It brings two literatures into conversation that have, for the most part, been talking past each other. It develops a new theoretical category, algorithmic-relational governance, that captures the hybrid character of governance in smart-contract-enabled alliances. And it formulates three propositions that can structure further empirical investigation, using the Walmart Canada case to show what kind of evidence would be needed to test them.

The remainder of the article is organised as follows. Section 2 sets out the research context and formulates the research questions. Section 3 reviews the relevant literatures. Section 4 presents the case study. Section 5 discusses the theoretical contributions, managerial implications and boundary conditions. Section 6 concludes with limitations and paths for future research.

2. Research Context and Research Questions

The challenge that motivates this article is, at its heart, fairly simple to state. Strategic alliances have always required their participants to combine two qualities that tend to pull in opposite directions: the certainty and enforceability of contractual mechanisms on the one hand, and the adaptive flexibility of relational mechanisms on the other (Ring & Van de Ven, 1992; Reuer & Ariño, 2002). Contracts protect against opportunism but cannot anticipate every contingency. Relational governance handles unforeseen contingencies through trust and ongoing negotiation but provides less certainty when interests diverge or memories grow short. The substitutes-complements debate that has occupied alliance scholars for the better part of two decades is, in many ways, an extended attempt to work out how these two mechanisms can be combined to most useful effect (Poppo & Zenger, 2002; Faems et al., 2008; Fischer et al., 2011).

Smart contracts complicate this picture in interesting ways. They promise a degree of certainty and enforceability that traditional contracts cannot match, since they execute automatically and resist tampering. They also promise to reduce some of the information asymmetries that make trust difficult to establish in the first place, since they record transactions immutably on a shared ledger that all parties can verify (Agrawal et al., 2023; Chen et al., 2023). At the same time, they introduce a new form of rigidity. Once deployed, they execute according to predetermined conditions, which sits awkwardly with the kind of adaptive renegotiation that alliances have long required (Reuer & Ariño, 2002; Murray et al., 2021).

This combination of features raises questions that the existing alliance governance literature is not yet equipped to answer. The article is built around three of them:

RQ1. How do blockchain-enabled smart contracts interact with the contractual and relational governance mechanisms that have been documented in the strategic alliance literature?

RQ2. What conditions shape the form and effectiveness of this interaction?

RQ3. What does this interaction imply for the way alliance performance should be understood when smart contracts form part of the governance mix?

The objectives that follow from these questions are equally specific. The first is to develop a theoretically grounded account of how algorithmic governance enters into the contractual-relational system that alliance scholars have described. The second is to identify the boundary conditions under which algorithmic governance is most likely to complement, replace or come into tension with the existing mechanisms. The third is to derive propositions that can guide further empirical investigation, ideally across different industries and over time. The literature review developed in the next section addresses the first of these objectives by laying out the two relevant streams of scholarship and identifying the conceptual ground on which they can be brought together.

3. Literature Review

3.1 Theoretical Foundations of Alliance Governance

Alliance governance has held the attention of strategy scholars for several decades, and the reasons are not difficult to identify. Alliances are inherently difficult to manage. They bring together firms with distinct goals, cultures and capabilities, and require them to coordinate under conditions of incomplete information and mutual vulnerability. Ring and Van de Ven (1992) capture this aptly in their description of cooperative relationships as structures that must be actively negotiated and renegotiated over time. Against this backdrop, Transaction Cost Economics (TCE) has provided the most influential theoretical framework for analysing how firms structure these arrangements. Adapted to the alliance context by Oxley (1997), Chen and Chen (2003) and others, Williamson's (1985) argument is that alliances occupy an intermediate position between markets and hierarchies. They arise when the costs of pure market exchange become too high, yet where full vertical integration is either unnecessary or impractical. From this vantage point, the question of governance form largely reduces to one of discriminating alignment: matching the attributes of a transaction with safeguards capable of curbing opportunistic behaviour.

As useful as it has been, this perspective has also faced substantial critique. Dyer and Singh (1998), in their articulation of the relational view, argue that TCE pays insufficient attention to the value-creating potential of alliances. Their central claim is that firms can generate rents that are relational in nature, meaning they cannot be produced by either firm in isolation, but only through the combination of their respective resources and routines. They identify four sources of such rents: relation-specific assets, knowledge-sharing routines, complementary resource endowments, and effective governance. The last of these is particularly interesting for present purposes because it is framed in a dual sense. Governance mechanisms, the authors argue, do constrain opportunism, but they also create the conditions under which partners become willing to invest in specialised assets and to share proprietary knowledge in the first place. This view departs

meaningfully from the cost-minimising logic of TCE and moves towards one where governance is also, and perhaps primarily, an enabler of value creation.

Chen and Chen (2003) offer empirical support for combining these perspectives. Studying the international alliances of Taiwanese firms, they find that while TCE is powerful in predicting whether firms choose equity-based or contractual forms, the resource-based view is more informative when it comes to finer distinctions, such as the choice between exchange and integration alliances within the contractual category. Their finding is relatively modest but revealing: no single theoretical lens appears sufficient to account for the variety of governance forms observed in practice. Alliances are hybrid constructions in which transactional and resource considerations operate simultaneously. Ring and Van de Ven (1992), working from a different angle, arrive at a compatible conclusion. Their process-oriented framework emphasises that governance choices cannot be adequately captured in static terms. Risk and trust, rather than asset specificity alone, structure the choice of cooperative form, and the resulting arrangements evolve as partners engage in iterative cycles of negotiation, commitment and execution. What this body of early work establishes is that alliance governance is better understood as a system in which several mechanisms interact than as a single structural choice.

3.2 The Interplay Between Contractual and Relational Governance

The question of how contracts and relational mechanisms interact has generated one of the most persistent debates in the alliance literature. At its heart lies a relatively simple puzzle: are they substitutes or complements? The substitution thesis, associated notably with Gulati (1995), holds that trust makes elaborate contractual safeguards largely redundant. Firms that have worked together repeatedly develop confidence in each other's integrity, and that confidence in turn allows them to economise on the drafting, monitoring and enforcement costs that formal contracts entail. Lee and Cavusgil (2006) take this further by showing that relational governance has a stronger positive effect on alliance performance than contractual governance alone, particularly through its capacity to support knowledge transfer over time. The underlying intuition is fairly plain: where partners trust one another, they do not need to write every contingency into a contract.

Poppo and Zenger (2002), however, challenge this view. Using survey data, they find that increases in contractual complexity are positively, not negatively, associated with relational governance. Well-crafted contracts, they argue, promote expectations of cooperation that help relational norms take root, while relational norms in turn provide the flexibility that written agreements cannot fully specify. On this reading, the two mechanisms are best understood as complements. Krishnan, Geyskens and Steenkamp (2016) add nuance to the debate by introducing uncertainty as a moderating condition. Their large-sample study shows that the relative effectiveness of contractual and trust-based governance depends on the type of uncertainty confronting the alliance. Under behavioural uncertainty both tend to work reasonably well. Under environmental uncertainty, however, trust-based governance outperforms contractual mechanisms, for the simple reason that the latter cannot anticipate the contingencies likely to arise.

Fischer, Huber and Dibbern (2011) contribute what may be the most useful reframing of the debate. Rather than asking whether contracts and trust are substitutes or complements, they ask how and why they become one or the other. Through a multiple-case study of IS outsourcing projects, they identify three archetypal processes through which the two mechanisms develop complementary relationships, and one process that leads to substitution. A key insight from their work is temporal: the same governance mechanisms can function as complements at one point in the relationship and as substitutes at another. Much of the apparent contradiction in the empirical literature, they suggest, may stem from studies that take cross-sectional snapshots of what is in reality an evolving process.

Faems, Janssens, Madhok and Van Looy (2008) offer what is probably the most integrative treatment of this issue to date. Their longitudinal comparison of two R&D alliances connects contract design, trust dynamics and contract application within a single analytical frame. What they find is that the same contract can be applied in markedly different ways depending on the trust context in which it operates. Under conditions of goodwill trust, contracts function as coordination devices that help partners align their expectations. Under distrust, the same provisions become control instruments, wielded to constrain partner behaviour. Contracts, in other words, are not self-interpreting. Their meaning and their effects depend on the relational context in which they are embedded. Mayer and Argyres (2004) add a further piece to this picture. Their study of contracts in the personal computer industry shows that firms learn to contract over time, and that prior experience leads them to develop more refined contractual provisions. Contracts, they conclude, function as knowledge repositories as much as safeguards against opportunism, a characterisation that sits uneasily with the more restrictive TCE view.

Reading these studies together, one is left with a fairly clear impression: alliance governance cannot be understood through either contractual or relational mechanisms on their own. Formal and informal elements co-evolve, shaped by the partners' history, the kinds of uncertainty they face, and the trust context in which they interact. The implication for the present article is straightforward. Any new governance mechanism that is introduced into an alliance must be assessed not in isolation but in terms of how it inserts itself into this evolving system.

3.3 Trust, Opportunism and the Dynamics of Governance

If trust is central in virtually every account of alliance governance, its precise relationship with formal contracting remains theoretically contested. Gulati (1995) shows that repeated ties between firms foster trust, which in turn reduces the perceived need for equity-based safeguards. Yasuda (2018) reaches a similar conclusion through a comparative analysis of governance forms, finding that trust-based governance tends to emerge where partners share congruent goals and have built up collaborative routines. The underlying logic is that trust economises on monitoring and enforcement, freeing up resources for value-creating rather than value-protecting activities.

Mikami et al. (2022) question this picture from a different angle. Drawing on the bounded reliability framework and case evidence from the Renault-Nissan Alliance, they argue that commitment failures in alliances often have little to do with opportunism as Williamsonian TCE would define it. They arise instead from what the authors call benevolent preference reversal or identity-based discordance, in which partners genuinely intend to honour their commitments and still fail to do so. Mikami et al. develop an equity-trust model in which distributive, procedural, informational and interpersonal justice collectively shape the emergence of trust and the avoidance of opportunism, considerably broadening the toolkit available for thinking about alliance governance beyond the rather narrow set of mechanisms that TCE has traditionally emphasised.

Reuer and Ariño (2002) draw attention to a dimension of alliance dynamics that has received comparatively little empirical attention: contractual renegotiation. Their analysis shows that both initial governance conditions and ex post contingencies contribute to post-formation governance changes. Alliances with misaligned governance at formation are more likely to undergo renegotiation, as are alliances exposed to shifts in strategy or environment. The implication is that static contract design, however sophisticated it may be, cannot fully anticipate the adaptive demands of long-lived cooperative relationships. Contracts in alliances are, or at least need to be, living documents.

What these studies suggest, considered as a whole, is that a central problem in alliance governance is how to combine two qualities that have tended to pull in opposite directions: the adaptive flexibility of relational mechanisms and the certainty and enforceability of contractual mechanisms. It is against this problem that blockchain-enabled smart contracts deserve closer examination.

3.4 Blockchain as a Distinct Governance Mechanism

Lumineau, Wang and Schilke (2021) were among the first to treat blockchain systematically as a governance mechanism. Their conceptual argument is that blockchain governance should be positioned alongside, rather than subsumed under, contractual and relational governance. Three features set it apart. Enforcement relies neither on legal recourse (as with contracts) nor on the value of future relationships (as with relational norms) but on protocols and code-based rules that are automatically executed by the underlying network. Direct personal connections between parties also become less essential, since the system itself ensures compliance with the agreed rules. And perhaps most strikingly, enforcement becomes prospective rather than retrospective: the logic is to prevent deviations from occurring in the first place by embedding constraints directly into the execution layer.

Lumineau et al. (2021) also propose that the impact of blockchain governance on traditional mechanisms depends heavily on the nature of the transaction. When transactions are explicit, and thus highly codifiable and verifiable, blockchain governance can replace both contractual and relational mechanisms, delivering equivalent or even superior enforcement at lower cost. When transactions are tacit, involving ambiguity and knowledge that resists codification, blockchain is a less effective substitute and more likely to operate as a complement.

This distinction between codifiable and non-codifiable exchange is arguably one of the most important boundary conditions identified in the literature to date. It tells us something fundamental about where smart contracts can and cannot be expected to work.

Murray, Kuban, Josefy and Anderson (2021) approach the question from a contracting and corporate governance angle. They argue that smart contracts alter some of the underlying assumptions of contract theory by allowing a shift from incomplete contracts that require ex post renegotiation towards more complete, self-executing agreements. They are careful to note, however, that smart contracts face real limitations when unforeseen contingencies arise, precisely the kinds of situations for which relational governance has traditionally been best suited. Onjewu, Walton and Koliouis (2023) go further still, developing a blockchain agency theory that systematically challenges the core assumptions of classical agency theory. They propose that blockchain alliances transform self-interest into common interest, conflicting goals into congruent goals, and information asymmetry into information symmetry. These are strong claims, and it is worth asking how much support they have received from the empirical work carried out so far.

3.5 Smart Contracts in Practice: Capabilities, Adoption and Performance

The conceptual enthusiasm surrounding smart contracts has, until fairly recently, outpaced the empirical evidence. That is beginning to change, and the change has accelerated noticeably over the past two to three years, with a cluster of empirical contributions published between 2024 and 2026 that together begin to give the field an evidentiary base it previously lacked (Bettini de Miranda et al., 2025; Eze & Ameyaw, 2025; Guo, 2025; Hanisch et al., 2025; Müller, 2025; Torkanfar et al., 2025; Xiong et al., 2025; Xu et al., 2025). Xiong, Ding, Guo, Choi and Lam (2025) provide what is probably the first large-sample quantitative investigation of the impact of blockchain-enabled smart contracts on firms' operational efficiency. Using the staggered enactment of smart contract laws in five U.S. states as a quasi-natural experiment, they find significant efficiency improvements in treated firms relative to matched controls, operating mainly through cost reduction and relationship enhancement rather than through the risk mitigation effects one might have expected. Their analysis also reveals meaningful moderation by supply chain complexity, with horizontally complex chains benefiting more and spatially complex chains benefiting less, results that begin to give concrete shape to the boundary conditions under which smart contracts deliver performance gains.

Guo (2025) offers a complementary treatment of smart contracts in supply chains, examining the conditions under which adoption improves coordination between parties. Prause (2019) provides an earlier conceptual bridge, arguing that automated verification and execution reduce the need for intermediaries and enhance the reliability of interfirm commitments. Agrawal et al. (2023) move the discussion closer to actual implementation. Their blockchain-based framework illustrates how consensus mechanisms and validation protocols can be tailored to specific partnership configurations, suggesting that some degree of flexibility is compatible with a structure of automated enforcement.

On the adoption side, Müller (2025) applies the UTAUT framework to German supply chain firms and finds that performance expectancy is the only significant predictor of adoption intention, with effort expectancy and social influence showing no meaningful effect. Managers, on this evidence, are drawn to smart contracts by the prospect of tangible operational benefits, not by ease of use or peer pressure. Eze and Ameyaw (2025) extend the adoption literature into public-private partnerships, identifying institutional, technological and organisational barriers that reinforce the view that adoption is unlikely to proceed uniformly across contexts.

Chen, Chen and Ou (2023) provide case-based evidence of how blockchain systems facilitate interorganisational trust in strategic alliances. Their study of two eastern banks shows that blockchain's affordances, notably transparency, immutability and distributed consensus, cultivate both competence-based and benevolence-based trust among partners. Xu et al. (2025) complement this work from the construction industry, finding that blockchain influences collaboration both directly and indirectly through calculative and relational trust, with technology readiness moderating these relationships (see also Torkanfar et al., 2025). What the empirical literature points to, collectively, is that the conceptual claim that smart contracts alter trust dynamics rather than simply replacing them is receiving at least preliminary support (see also Bettini de Miranda et al., 2025).

3.6 Synthesis: Towards a Theory of Algorithmic-Relational Governance

The two bodies of work reviewed above have, for the most part, developed in parallel. The alliance governance literature has produced a sophisticated understanding of how contractual and relational mechanisms interact and co-evolve. The blockchain literature has shown how algorithmic governance can automate enforcement, reduce transaction costs and reshape trust dynamics. What is still missing is a framework explaining how the new mechanism enters into, reconfigures or potentially disrupts the established system in the specific context of strategic alliances.

Three theoretical tensions come into focus when the two literatures are brought into conversation. The first concerns contractual completeness. Mainstream alliance research has long emphasised that contracts are inevitably incomplete (Mayer & Argyres, 2004; Reuer & Ariño, 2002), yet smart contracts presuppose a level of codifiability that may not exist in the relationally complex collaborations characteristic of many alliances (Lumineau et al., 2021; Murray et al., 2021). They cannot describe what cannot first be codified.

A second tension concerns trust. The substitutes-complements debate has shown that trust and contracts interact in complex, path-dependent ways (Poppo & Zenger, 2002; Faems et al., 2008; Fischer et al., 2011). Blockchain governance introduces what might be called system trust, in which parties need not trust one another personally because the algorithmic infrastructure guarantees compliance (Lumineau et al., 2021; Chen et al., 2023). Whether this form of trust substitutes for, complements or redefines the interpersonal and interorganisational trust that alliance scholars have studied for years is an open question.

A third tension concerns adaptation. Successful alliances have been shown to evolve through iterative cycles of negotiation, commitment and renegotiation (Ring & Van de Ven, 1992; Reuer & Ariño, 2002), yet smart contracts execute according to predetermined conditions and resist modification once deployed (Murray et al., 2021; Onjewu et al., 2023). The rigidity may be efficient for routinised transactions, but it sits awkwardly with the kind of adaptive flexibility relational governance has traditionally provided.

My reading of these tensions is that smart contracts do not simply add a new tool to the existing governance repertoire. They have the potential to reconfigure the relationships among the mechanisms already in place, producing a hybrid form that can usefully be termed algorithmic-relational governance. In this hybrid form, the codifiable and verifiable dimensions of alliance exchange are governed algorithmically, while the tacit, emergent and ambiguous dimensions remain governed relationally. The boundary between these two domains, and the mechanisms through which they interact, is where the central theoretical puzzle of this article lies. The case study presented in the next section illustrates, in a concrete setting, how that boundary takes shape in practice.

Table 1. Summary of Key Studies Reviewed

Author(s) & Year	Theme	Theoretical Lens	Method	Key Findings
Dyer & Singh (1998)	Alliance governance	Relational view	Conceptual	Four sources of relational rents; effective governance enables value creation beyond cost minimisation
Gulati (1995)	Trust & governance	TCE / Embeddedness	Quantitative	Repeated ties breed trust and reduce reliance on equity-based governance
Poppo & Zenger (2002)	Substitutes vs. complements	TCE / Relational	Quantitative (survey)	Formal contracts and relational governance function as complements, not substitutes
Faems et al. (2008)	Contract design & trust	Integrative	Longitudinal case study	Trust context determines whether contracts function as coordination devices or control instruments
Krishnan et al. (2016)	Governance effectiveness	TCE / Trust	Quantitative	Effectiveness of contractual vs. trust-based governance depends on uncertainty type
Lumineau et al. (2021)	Blockchain governance	Governance theory	Conceptual	Blockchain as a third governance mechanism; impact depends on transaction codifiability and verifiability
Murray et al. (2021)	Smart contracts & contracting	Contract theory	Conceptual	Smart contracts enable more complete, self-executing agreements but face limitations with unforeseen contingencies
Onjewu et al. (2023)	Blockchain agency theory	Agency theory	Conceptual (problematisation)	Blockchain challenges core agency theory assumptions; smart contracts replace efficiency-based contracting with automated execution
Xiong et al. (2025)	Smart contracts & efficiency	TCE	Quasi-natural experiment (DID)	Smart contracts improve operational efficiency through cost reduction and relationship enhancement; effects moderated by supply chain complexity
Chen et al. (2023)	Blockchain & trust	Affordance theory	Multiple case study	Blockchain cultivates competence- and benevolence-based trust; smart contracts automate verification and reduce information asymmetry
Muller (2025)	Smart contract adoption	UTAUT	Survey / PLS-SEM	Performance expectancy is the sole significant predictor of smart contract adoption in supply chains
Mikami et al. (2022)	Trust & opportunism	Bounded reliability / Justice	Abductive case study	Equity-trust model: organisational justice mechanisms shape trust and constrain opportunism beyond TCE predictions

Table 2. Mapping Alliance Governance Mechanisms to Smart Contract Capabilities

Alliance Governance Challenge	Traditional Mechanism	Smart Contract Capability	Interaction Effect
Opportunism / moral hazard	Contractual safeguards, monitoring, trust	Automated execution, immutable records, transparency	Replacement for codifiable exchanges; complement for tacit exchanges
Information asymmetry	Disclosure clauses, relational norms, reputation	Distributed ledger, real-time data sharing, consensus validation	Complement: algorithmic transparency reinforces relational trust
Coordination complexity	Division of labour clauses, interface structures, joint committees	Self-executing workflows, automated trigger conditions	Replacement for routinised tasks; relational mechanisms needed for non-routine adaptation
Contract incompleteness	Renegotiation provisions, relational flexibility	Comprehensive algorithmic specification of codifiable contingencies	Tension: algorithmic rigidity versus need for adaptive renegotiation
Transaction cost reduction	Trust-based economising, repeat interactions	Elimination of intermediaries, automated verification and payment	Complement: cost savings from both relational economising and algorithmic automation
Knowledge sharing / learning	Relational capital, knowledge-sharing routines	Secure data sharing, cryptographic access controls	Complement: algorithmic infrastructure enables the secure knowledge exchange that relational trust motivates

4. Illustrative Case Study: Walmart Canada and the DL Freight Smart Contract Network

4.1 Rationale and Case Selection

The framework developed in the preceding sections rests on the proposition that smart contracts in strategic alliances operate neither as pure algorithmic substitutes for relational governance nor as simple technological add-ons to existing contractual arrangements. What I

have argued instead is that they act as catalysts for a distinct hybrid mode of governance, which I have termed algorithmic-relational governance. In order to ground this proposition in observable practice, and to illustrate the mechanisms through which algorithmic and relational elements interact in a concrete setting, I now turn to an illustrative case study: Walmart Canada's deployment of blockchain-enabled smart contracts across its third-party freight carrier network.

The case was selected on the basis of three criteria. To begin with, it involves a genuine multi-party alliance structure in which governance challenges are far from trivial. It also represents a full-scale, production-grade implementation rather than a proof-of-concept pilot, which means that the outcomes are realised rather than merely projected. Finally, it is extensively documented through multiple independent sources, including a Harvard Business Review practitioner account (Vitasek et al., 2022), industry case material published by the Hyperledger Foundation (Linux Foundation Decentralized Trust, 2020), trade press coverage (Straight, 2019; SupplyChainBrain, 2020) and technology journalism (Mearian, 2019). Each source has its own limitations, but read across them they offer enough empirical detail to support a theoretically informed analysis without relying on proprietary or unverifiable data.

A qualification about these sources is nevertheless in order. Because the case rests exclusively on secondary material produced by the implementing parties, their technology partner, or trade and business outlets that tend to feature successful deployments, the evidentiary base carries a pro-innovation bias that a careful reader should keep in view. Accounts of this kind are rarely neutral. They are written to communicate a favourable story about the platform and its effects, and they have little incentive to report the frictions, workarounds or unresolved tensions that typically accompany any organisational change of this scale. The human dimensions of relational capital, including how carriers actually experienced the transition, how trust was negotiated at the individual level, and whether the gains reported at the aggregate level are evenly distributed across participants, cannot be adequately assessed from such materials. The case is therefore used here as an illustration rather than as a confirmation of the framework. A fuller empirical assessment would require primary data, including interviews with carriers, observation of design and exception-handling practices, and longitudinal tracking of the relational dynamics that the secondary record cannot reach. That requirement is revisited in the limitations section.

4.2 The Governance Challenge: Information Asymmetry and Contractual Friction in Freight Logistics

Walmart Canada operates one of the largest retail distribution networks in North America. The company moves more than 853 million cases of merchandise annually through 11 distribution centres that supply over 400 retail stores across the country (Vitasek et al., 2022). To accomplish this, it relies on a combination of its own fleet, consisting of approximately 180 tractors, 2,000 trailers and over 350 drivers, and a network of roughly 70 independent third-party freight carriers, each operating under distinct contractual arrangements (Straight, 2019). The relationship between Walmart Canada and its carriers is a reasonably clean example of what Ring and Van de Ven (1992) describe as a cooperative interorganisational relationship, characterised by recurrent transactions, moderate asset specificity and significant informational complexity. Each carrier maintains its own systems for calculating shipping costs on the basis of individual contracts that stipulate varying rates for fuel surcharges, line-haul charges, accessorial fees and other variables. The result is a network in which roughly 220 distinct data points must be reconciled for every individual load that moves through the system (Linux Foundation Decentralized Trust, 2020).

Prior to the blockchain implementation, this informational complexity produced severe governance failures. Across the industry, an estimated 70 per cent of freight invoices were subject to some form of dispute, collectively tying up approximately \$140 billion in delayed settlements across the transportation sector (Mearian, 2019). Walmart Canada was not exempt from the pattern. Interestingly, the root cause was not, as a purely economic analysis might suggest, opportunistic behaviour by either party. The disputes arose instead from what the technology partner's leadership described as a fundamental trust deficit rooted in incompatible information systems and the absence of a shared, verifiable data foundation (Linux Foundation Decentralized Trust, 2020). Each side maintained its own records and carried out its own calculations in isolation, producing what amounted to a fragmented double-entry system in which discrepancies were structural rather than strategic. Viewed through the transaction cost economics lens articulated by Oxley (1997), the situation displays classic symptoms of high ex post transaction costs. Verification consumed disproportionate administrative resources, reconciliation delays strained carrier relationships, and the cumulative friction drove administrative expenses to roughly 20 per cent of total transportation costs (SupplyChainBrain, 2020).

The problem was not, however, amenable to a straightforward contractual solution. As Mayer and Argyres (2004) have shown, firms do learn to write more complete contracts over time, but the freight logistics context presents a particularly intractable form of contractual incompleteness. The variability inherent in transportation (weather, route deviations, fuel price fluctuations, delivery timing) means that no ex ante contract could fully specify the terms applicable to every shipment. Reuer and Ariño (2002) have shown that such contingencies frequently trigger contractual renegotiations in strategic alliances. In the Walmart Canada setting, virtually every shipment was becoming a micro-renegotiation event in its own right. The sheer volume of these events, in excess of 500,000 loads per year, rendered traditional governance mechanisms insufficient no matter how carefully they had been designed.

4.3 The Algorithmic Intervention: Design and Deployment of the DL Freight Platform

In 2019, Walmart Canada partnered with DLT Labs, a Toronto-based enterprise blockchain firm, to develop and deploy what became known as DL Freight. The platform is a blockchain-based system built on Hyperledger Fabric, designed to manage the entirety of the company's freight invoicing, payment and reconciliation processes (Linux Foundation Decentralized Trust, 2020). It was configured and deployed in approximately 60 days and entered full production by early 2020, covering all of Walmart Canada's third-party carrier operations (Straight, 2019). Several features of the system's architecture are directly relevant to the theoretical argument developed in the preceding sections.

The first is that the platform translated Walmart Canada's paper-based contracts with each carrier into executable smart contracts. These encoded the specific rate structures, surcharge calculations, accessorial fee schedules and payment triggers applicable to each

carrier relationship (Mearian, 2019). In the language used by Luminé et al. (2021), this represents a shift from contractual governance as traditionally understood, where written agreements require human interpretation and enforcement, to algorithmic governance, where encoded rules execute automatically upon the satisfaction of verifiable conditions. The smart contracts calculated freight costs based on pre-agreed terms and triggered invoice generation and payment settlement without requiring manual intervention (Vitasek et al., 2022). The automated execution eliminated the interpretive ambiguity that Faems et al. (2008) identified as a principal source of governance failure in alliances where contract application diverges from contract design.

The second feature is the integration of Internet of Things sensors and GPS tracking devices installed on shipments and vehicles. These devices automatically recorded data such as distances travelled, temperature conditions, delivery timestamps and route information, which were then immutably logged on the distributed ledger. What emerged was what Agrawal et al. (2023) describe as a shared, tamper-proof information foundation. The significance of this arrangement goes well beyond simple data accuracy. By establishing a single, consensus-based version of transactional reality accessible to all parties, the platform eliminated the structural information asymmetry that had been generating disputes in the first place. In the framework proposed by Chen et al. (2023), this represents a data-level affordance of blockchain technology, one that enables interorganisational collaboration by ensuring data encryption, authenticity and consistency across alliance partners.

The third feature is architectural. The platform was built on a permissioned blockchain using Hyperledger Fabric's channel mechanism, which allowed each carrier to maintain an independent and confidential relationship with Walmart Canada while still participating in the shared network (Linux Foundation Decentralized Trust, 2020). This design choice is worth dwelling on, because it addresses a concern that Guo (2025) raises in the context of smart contract adoption in supply chains: the risk that transparency may disadvantage certain parties by exposing competitively sensitive information. By partitioning the network into private channels, the system preserved the confidentiality of each carrier's specific contractual terms while still delivering the verification and automation benefits of the shared ledger. The decision reflects what Murray et al. (2021) describe as a key design parameter in blockchain-enabled contracting: the need to balance the transparency required for trust with the privacy required for competitive positioning.

4.4 Governance Outcomes: From Contractual Friction to Algorithmic-Relational Governance

The measurable outcomes of the DL Freight implementation were substantial. Invoice disputes fell from over 70 per cent to less than 2 per cent, a reduction of roughly 97 per cent (SupplyChainBrain, 2020). Payment cycles accelerated significantly as real-time reconciliation replaced the protracted manual verification process. Administrative costs associated with freight management decreased markedly, and Walmart Canada gained, for the first time, precise visibility into

its true freight costs by route and carrier (Vitasek et al., 2022). From the carriers' perspective, invoices were now being generated in real time, proof of delivery became automated, and the overall administrative burden of managing the Walmart Canada relationship was substantially lighter (SupplyChainBrain, 2020).

These outcomes can be read through the transaction cost economics lens that Xiong et al. (2025) apply in their empirical analysis of smart contract effects on operational efficiency. The reduction in dispute rates and administrative costs reflects directly the transaction cost minimisation that TCE predicts when governance mechanisms are better aligned with transactional characteristics. The findings are consistent too with Xiong et al.'s (2025) empirical evidence that smart contract adoption improves operational efficiency primarily through cost reduction and relationship stabilisation, rather than through firm risk mitigation alone.

A purely transactional interpretation, however, misses what is arguably the most theoretically significant dimension of the case. The DL Freight platform did not merely reduce costs. It altered, in a fundamental way, the relational dynamics between Walmart Canada and its carrier partners. Prior to the implementation, the governance relationship exhibited characteristics of what Krishnan et al. (2016) term a high-uncertainty environment: contractual governance alone was insufficient, and trust-based governance struggled to gain traction because the informational foundations for trust were absent. The carriers could not trust Walmart's calculations because they had no independent means of verifying them, and Walmart could not trust the carriers' invoices for the same reason. It is at this specific impasse that the platform intervened, and it did so not by replacing trust with algorithmic enforcement but by creating the informational conditions under which trust could be cultivated. As one DLT Labs executive put it, the core problem the platform addressed was to enable Walmart and its carriers to trust each other by providing a shared, immutable source of truth (Linux Foundation Decentralized Trust, 2020).

This observation lines up with Chen et al.'s (2023) finding that blockchain-based systems afford the development of both competence-based and integrity-based interorganisational trust by establishing process visibility, traceability and automation. In the Walmart Canada case, the smart contract layer did not eliminate the need for relational governance. It created the conditions under which relational governance could function effectively. Carriers reported that the system allowed them to forge stronger and more trusting relationships with Walmart Canada (SupplyChainBrain, 2020), a finding that sits comfortably with Poppo and Zenger's (2002) complementarity thesis. The algorithm did not replace trust. What it did was establish a credible commitment mechanism that allowed trust to develop in an environment where it had previously been impossible.

4.5 Theoretical Interpretation: The Walmart Canada Case as Algorithmic-Relational Governance

The Walmart Canada case illustrates several features of the algorithmic-relational governance mode advanced in the preceding sections. A first observation is that smart contracts in alliance contexts are not

self-implementing technical artefacts. The design of the smart contract parameters required extensive collaboration between Walmart Canada's freight, legal and finance departments and all participating carriers. All parties had to agree that the encoded business logic accurately and fairly represented their contractual agreements before the system could process transactions automatically (Linux Foundation Decentralized Trust, 2020). This collaborative design process is itself a form of what Ring and Van de Ven (1992) describe as the negotiation and commitment stages of cooperative relationship development, where partners establish the terms and governance structures that will guide their ongoing interaction. The algorithmic layer, far from bypassing this relational process, demanded a more intensive and explicit version of it.

The case also reveals how smart contracts can alter power dynamics within alliance relationships. Murray et al. (2021) have argued that smart contracts may reduce the asymmetric bargaining power larger firms exercise over smaller counterparties, by ensuring that contractual terms are executed as written rather than as the dominant party chooses to interpret them. The effect is clearly visible in the Walmart Canada context. The smaller carriers, which previously lacked the administrative resources to contest Walmart's calculations or the financial capacity to absorb protracted payment delays, gained a form of procedural equity through the automated, rule-based execution of their contracts. This dimension of the case resonates with Mikami et al.'s (2022) theory of equity-trust in the Renault-Nissan Alliance, where organisational justice mechanisms were found to mitigate opportunism and foster trust. In the Walmart Canada case, the algorithmic layer performs an analogous function. By ensuring procedural fairness through automated, transparent and impartial contract execution, it produces what might reasonably be termed algorithmic justice, a technology-mediated form of the procedural and distributive justice that Mikami et al. (2022) identify as foundational to sustained alliance collaboration. The parallelism is worth drawing out a step further. In Mikami et al.'s (2022) account, distributive justice emerges over time as partners observe how economic outcomes are allocated across repeated interactions, and procedural justice is cultivated through fair and consistent decision-making. In a smart-contract-enabled alliance, these dynamics are partially collapsed into a single technological layer. The encoded rules take responsibility for procedural consistency by executing identically for every transaction, and they take on part of the work of distributive fairness by applying the agreed rate structures and payment triggers without discretionary adjustment. Algorithmic justice does not replicate the full substantive content of distributive justice, since it cannot judge whether the underlying allocation is normatively fair, but it can function as a technological mediator, and at the margin as a partial substitute, during the fragile early stages of trust formation in which partners lack a shared history of observed behaviour to draw upon. By establishing an impartial allocative baseline from the outset, it shortens the interval during which the absence of distributive evidence would otherwise stall the emergence of relational trust.

A third observation concerns the boundary conditions of algorithmic governance. The DL Freight platform handles routine, codifiable

transactions with precision, but it does not address the full range of contingencies that arise in complex interorganisational relationships. Exceptional circumstances, novel situations and strategic disagreements still require human judgement, negotiation and the kind of relational capital that Dyer and Singh (1998) identify as a source of interorganisational competitive advantage. The system, tellingly, includes mechanisms for flagging exceptions for manual review (Vitasek et al., 2022), an implicit acknowledgement that algorithmic governance functions most effectively within a broader relational governance frame. This complementarity is precisely what the theoretical argument set out earlier predicts.

The case also speaks to adoption. Müller (2025) and Eze and Ameyaw (2025) identify performance expectancy, effort expectancy, facilitating conditions and institutional support as critical factors for blockchain-enabled smart contract adoption. The DL Freight platform succeeded in part because it was designed to integrate seamlessly with carriers' existing enterprise resource planning systems, requiring no investment in new technology or significant changes to established workflows (Linux Foundation Decentralized Trust, 2020). This design principle lowered adoption barriers and addressed the resistance that Müller (2025) identifies as a meaningful impediment to smart contract diffusion in supply chain contexts.

4.6 Case Synthesis and Implications for Theory Development

The Walmart Canada case provides empirical grounding for the broader theoretical framework set out in this paper. Three propositions emerge from it, each pointing toward dimensions of governance that transaction cost economics alone cannot fully capture. The case is, of course, a single instance, and the limits of what can be inferred from it are real. But the dynamics it documents are suggestive enough to warrant systematic empirical investigation across other settings. The discussion section that follows develops the three propositions formally and considers their implications for theory, practice and future research.

5. Discussion

5.1 Three Propositions

The literature review developed in Section 3 and the case study presented in Section 4 lead, in my view, to a fairly clear set of conclusions about how smart contracts operate in strategic alliances. These conclusions can be formalised as three propositions, which together constitute the core contribution of the article.

Proposition 1. Blockchain-enabled smart contracts in strategic alliances function primarily as governance complements rather than substitutes. They do not displace relational trust; they enhance it by establishing credible, transparent and impartial enforcement of the codifiable dimensions of contractual terms.

This proposition emerges from both literatures. Lumineau et al. (2021) argue, on conceptual grounds, that the impact of blockchain on traditional governance depends on the codifiability of the underlying transaction. Chen et al. (2023) provide case evidence that blockchain affordances cultivate competence-based and benevolence-

based trust rather than displacing them. The Walmart Canada case shows the same pattern in operation. The DL Freight platform did not eliminate the need for working relationships between Walmart and its carriers; if anything, it required a more intensive version at the design stage and produced stronger ones at the operational stage (Vitasek et al., 2022; SupplyChainBrain, 2020). The substitution view finds little support either in the recent empirical work or in the case considered here.

Proposition 2. The introduction of smart contracts alters alliance governance dynamics in ways that transaction cost economics alone cannot predict. Information asymmetries are restructured, bargaining power is redistributed, and new forms of procedural justice emerge that shape trajectories of relational trust over time.

This is perhaps the most theoretically interesting of the three propositions, because it suggests that the conventional TCE framing (Williamson, 1985; Oxley, 1997) is insufficient to capture what smart contracts actually do in alliance settings. Murray et al. (2021) hint at this in their discussion of how smart contracts may alter bargaining power, and Onjewu et al. (2023) develop the point more systematically through their blockchain agency theory. The Walmart Canada case is suggestive in this respect. The smaller carriers gained a form of procedural equity through automated, rule-based execution that they had previously lacked, and this in turn shaped how they came to view the relationship. The dynamic resonates with Mikami et al.'s (2022) equity-trust model, in which organisational justice mechanisms shape the emergence of trust and the avoidance of opportunism. Something analogous may happen when algorithmic justice supplements the procedural mechanisms that humans would otherwise have to enforce.

Proposition 3. Effective algorithmic-relational governance requires deliberate architectural design choices that are themselves the product of relational negotiation between alliance partners. Decisions about network permissioning, data partitioning, exception handling and system interoperability shape what the algorithmic layer can and cannot do.

This proposition draws on the technical features of the Walmart Canada implementation and on the more general arguments developed by Agrawal et al. (2023), Guo (2025) and Murray et al. (2021). It is worth emphasising because it cuts against a tempting but mistaken view of smart contracts as autonomous, plug-and-play solutions. They are nothing of the sort. The algorithmic layer in any real alliance has to be designed, parameterised and continuously monitored by human partners who themselves have to negotiate and agree on what the encoded business logic should look like. Ring and Van de Ven's (1992) account of the negotiation and commitment stages of cooperative relationship development is, if anything, more relevant in the algorithmic-relational setting than in the traditional one, not less.

5.2 Theoretical Contributions

The article makes three contributions to existing scholarship. The first is to the alliance governance literature. By introducing algorithmic governance as a distinct third mechanism alongside contractual and

relational governance, the framework extends the substitutes-complements debate into territory it has not previously occupied (Faems et al., 2008; Fischer et al., 2011; Mayer & Argyres, 2004). The introduction of a third mechanism, with its own distinctive properties, provides a way of accounting for the kinds of governance innovations now beginning to appear in practice.

The second contribution is to the blockchain governance literature. Lumineau et al. (2021) opened the conceptual ground by treating blockchain as a governance mechanism in its own right. The present article extends their argument by developing the interaction between blockchain governance and the established contractual-relational system in greater detail, and by identifying the conditions under which the interaction takes different forms. The case study, in particular, supplies the kind of grounded evidence that the conceptual literature has so far been short of (see also Chen et al., 2023; Xiong et al., 2025).

The third contribution lies in the substitutes-complements debate itself. The Walmart Canada case provides reasonably clear support for the complementarity view advanced by Poppo and Zenger (2002), and it does so with respect to a governance mechanism that did not exist when the original debate was framed. This is, in my view, a useful demonstration of the underlying logic of complementarity, and one that suggests the debate may be moving towards a more settled answer than it appeared to be a decade ago.

5.3 Managerial Implications

For practitioners considering smart contract adoption in their alliance arrangements, three implications follow. The first is that smart contracts should not be approached as a substitute for the hard work of relationship building. The Walmart Canada case suggests that the technology amplifies what is already there, for better or for worse. Where the relational foundations are weak, automated execution is unlikely to fix them. Where they are reasonably solid, smart contracts can reinforce and extend them.

The second implication concerns design. The architectural choices made in DL Freight, including the permissioning structure, the use of private channels, the integration with existing carrier systems and the inclusion of exception-handling mechanisms, were not incidental. They were essential to making the platform work in a setting where carriers had legitimate concerns about confidentiality, technological capacity and integration cost (Linux Foundation Decentralized Trust, 2020). Managers contemplating similar deployments should expect to spend considerable time on these architectural questions and should treat them as governance decisions in their own right.

The third implication concerns scope. Smart contracts work best for the codifiable, repetitive and verifiable dimensions of alliance transactions. Strategic disagreements, novel contingencies and the kinds of complex judgement calls that arise in long-lived relationships still require human intervention and the relational mechanisms that go with them. Managers should be clear-eyed about where the algorithmic layer ends and where the relational layer begins, and should design their alliances with that boundary in mind.

5.4 Boundary Conditions

The argument advanced in this article has clearer applicability in some settings than in others. Four boundary conditions deserve mention. The first is transaction codifiability. The more codifiable the transactions an alliance must coordinate, the more useful smart contracts are likely to be (Lumineau et al., 2021). Walmart Canada sits at a relatively favourable point on this dimension, since freight invoicing is highly codifiable in principle. Alliances built around tacit knowledge exchange or co-creation of novel products will face quite different conditions.

The second is alliance complexity. Xiong et al.'s (2025) finding that horizontally complex supply chains benefit more from smart contract adoption while spatially complex supply chains benefit less suggests that complexity is not a single dimension and that different forms interact with smart contracts in different ways.

The third is partner familiarity. Gulati's (1995) argument that repeated ties breed trust applies in this setting too. Alliances between partners who have worked together before are likely to find the design phase of a smart contract deployment easier, since they already share a common understanding of what the contract is supposed to do. New alliances may struggle with the negotiation work that has to happen before the algorithmic layer can be activated.

The fourth is institutional readiness. Eze and Ameyaw (2025) and Müller (2025) draw attention to the institutional, technological and organisational conditions that shape adoption. Smart contracts are not equally feasible in all jurisdictions or all industries, and the legal and regulatory environment matters in ways that conceptual treatments sometimes downplay (see also Hanisch et al., 2025).

6. Conclusion

The argument I have developed in this article rests on a fairly simple observation. Smart contracts are not, despite what some of the more enthusiastic claims have suggested, a substitute for the contractual and relational governance mechanisms that alliance scholars have spent decades studying. They are, instead, a new addition to the governance toolkit, one that interacts with the existing mechanisms in ways that depend on the codifiability of the underlying exchange, the complexity of the alliance, the familiarity between the partners, and the institutional environment in which they operate.

The framework I have proposed, which I have termed algorithmic-relational governance, is intended to capture this hybrid character. In its present form, it is conceptual and illustrative rather than empirical. The Walmart Canada case provides grounded evidence for the three propositions that emerge from the framework, but a single case is, by its nature, suggestive rather than conclusive. The natural next step is empirical work that can test these propositions across different industries, different governance structures and different time horizons.

Several lines of further enquiry seem to me particularly worth pursuing. Comparative studies across industries with markedly different codifiability profiles would help refine the boundary conditions sketched in the discussion. Longitudinal studies tracing the co-evolution of algorithmic and relational mechanisms would speak to the dynamic dimension that Fischer et al. (2011) and Faems et al. (2008) identified as central in the traditional setting. And quantitative work along the lines pioneered by Xiong et al. (2025), examining the operational consequences of smart contract adoption across larger samples, would be a useful complement to the conceptual and case-based work pursued here.

The technology is moving quickly, and the gap between practice and theory is widening. The contribution of this article is to begin to bring the two closer together, by offering a framework that takes both seriously and by showing how it can be applied to a real and well-documented example. There is much more to do, and I hope that other scholars will find the framework useful as a starting point for the kind of empirical work the field now needs.

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Data Availability Statement

This is a conceptual article. The case study presented in Section 4 draws exclusively on publicly available secondary sources, all of which are listed in the reference list and remain accessible at the URLs provided.